

FIG. 1

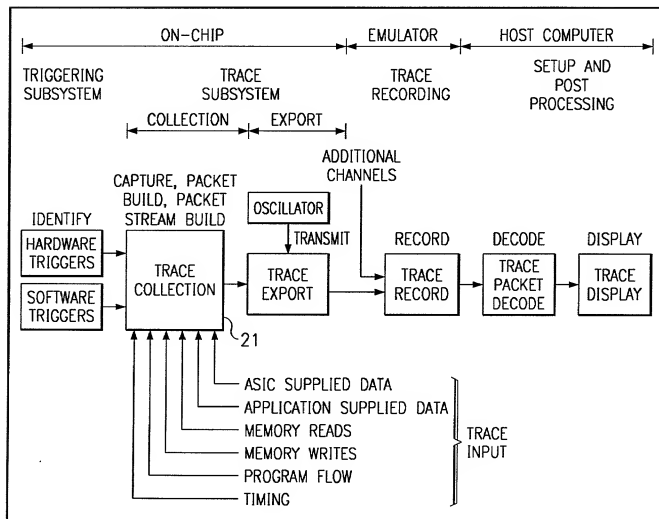


FIG. 2

| OPCODE       | COMMAND MEANING                  |
|--------------|----------------------------------|
| 00 0000 0000 | NO INFORMATION                   |
| 00 0000 0001 | RESERVED                         |
| 00 0000 0010 | PC TRACE GAP                     |
| 00 0000 0011 | REPEAT INSTRUCTION               |
| 00 0000 0100 | COUNTER START                    |
| 00 0000 0101 | COUNTER OVERFLOW/COUNTER VALUE   |
| 00 0000 0110 | RESERVED                         |
| 00 0000 0111 | COMMAND ESCAPE                   |
| 00 0000 1xxx | EXCEPTION OCCURRED               |
| 00 0001 0xxx | TIMING SYNC POINT                |
| 00 0001 1xxx | MEMORY REFERENCE SYNC POINT      |
| 00 0010 xxxx | PC SYNC POINT/FIRST/LAST/TRIGGER |
| 00 010x xxxx | SAME PC                          |
| 00 011x xxxx | CPU AND ASIC DATA                |
| 00 10xx xxxx | RESERVED                         |
| 00 11xx xxxx | MEMORY REFERENCE BLOCK           |
| 01 xxxx xxxx | BRANCH/BEGINNING OF PARAMETER    |
| 10 xxxx xxxx | CONTINUE                         |
| 11 xxxx xxxx | TIMING                           |

FIG. 3

## TIMING PACKET EXAMPLES

| OPCODE | CYCLE BITS | MEANING   |
|--------|------------|---|
| 11     | 00000000   | 8 CONSECUTIVE CYCLES OF EXECUTION   |
| 11     | 11111111   | 8 CONSECUTIVE STALL CYCLES  |
| 11     | 11110000   | THE RIGHT MOST BITS INDICATE THE PROCESSOR EXECUTED FOR 4 CYCLES AND THEN STALLED 4 CYCLES    |
| 11     | 10101010   | THE BITS MEAN EXECUTE, STALL, EXECUTE, STALL, EXECUTE, STALL, EXECUTE, AND STALL RESPECTIVELY |

FIG. 4

## TIMING SYNC PACKET

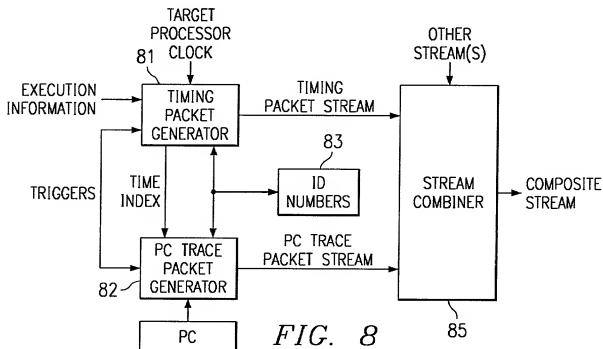
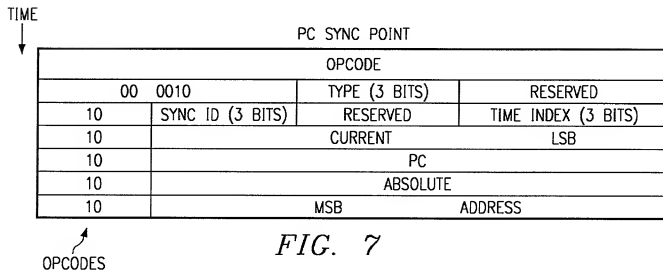
|                    |                  |
|--------------------|------------------|
| TIMING SYNC HEADER | 3-BIT PC SYNC ID |
|--------------------|------------------|

FIG. 5

PC SYNC POINT TYPES

| TYPE | SYNC TYPE   | REASON FOR SYNC POINT  |
|------|-------------|------------------------|
| 000  | TRIGGER     | USER DEFINED TRIGGER   |
| 001  | FIRST POINT | STANDBY MODE           |
| 010  | SYNC POINT  | PERIODICALLY GENERATED |
| 011  | FIRST POINT | STREAM ENABLED         |
| 100  | LAST POINT  | STREAM DISABLED        |

FIG. 6



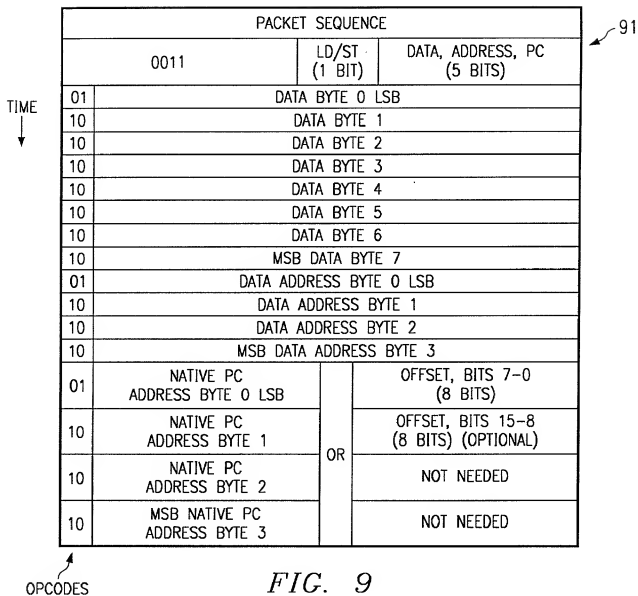
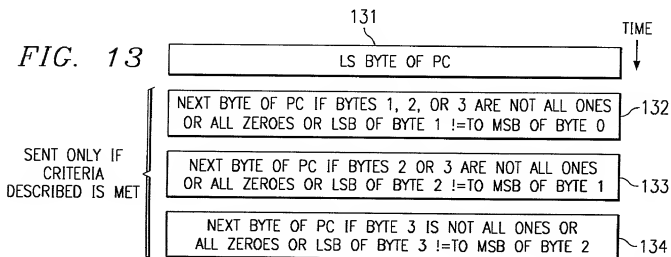
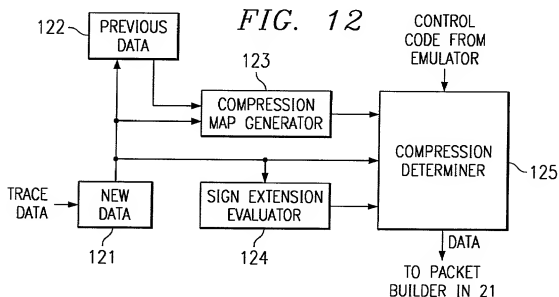
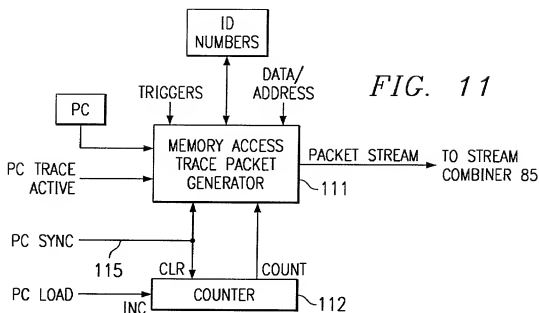


FIG. 9

## MEMORY REFERENCE SYNC POINT

| OPCODE   | PARAMETER FIELD (3-BITS) |
|----------|--------------------------|
| 00 00011 | MSB SYNC ID LSB          |

FIG. 10



| COMPRESSION EXAMPLE 0    |  |                                       |          |
|--------------------------|--|---------------------------------------|----------|
| PREVIOUS DATA            |  | 11111111 11111111 11111111            | 10000011 |
| NEW DATA                 |  | 11111111 11111111 11111111            | 10000011 |
| COMPRESSION BIT MAP SENT |  | NONE BECAUSE ONLY ONE BYTE COMPRESSES |          |
| SEND BYTES               |  | DROPPED DROPPED DROPPED               | SENT     |
|                          |  | BYTE #0 IS SENT                       |          |

FIG. 14

| COMPRESSION EXAMPLE 1    |  |                                     |          |
|--------------------------|--|-------------------------------------|----------|
| PREVIOUS DATA            |  | 11111111 11111111 11111111          | 10000011 |
| NEW DATA                 |  | 11111111 11111111 11111111          | 10000100 |
| COMPRESSION BIT MAP SENT |  | NO BECAUSE ONLY ONE BYTE COMPRESSES |          |
| SEND BYTES               |  | DROPPED DROPPED DROPPED             | SENT     |
|                          |  | BYTE #0 IS SENT                     |          |

FIG. 15

| COMPRESSION EXAMPLE 2    |  |  |          |
|--------------------------|--|--|----------|
| PREVIOUS DATA            |  | 11101111 11101111 11101111                                   | 10000011 |
| NEW DATA                 |  | 11101111 11101111 11101111                                   | 10000100 |
| COMPRESSION BIT MAP SENT |  | YES BECAUSE NO SIGN EXTENSION AND TWO OR MORE BYTES COMPRESS |          |
| SEND BYTES               |  | DROPPED DROPPED DROPPED                                      | SENT     |
|                          |  | BYTE #0 IS SENT  |          |

FIG. 16

| COMPRESSION EXAMPLE 3    |  |  |          |
|--------------------------|--|--|----------|
| PREVIOUS DATA            |  | 00001000 01111110 11000011                                   | 10000100 |
| NEW DATA                 |  | 11111111 11111111 11000011                                   | 10000100 |
| COMPRESSION BIT MAP SENT |  | YES BECAUSE NO SIGN EXTENSION AND TWO OR MORE BYTES COMPRESS |          |
| SEND BYTES               |  | DROPPED DROPPED DROPPED                                      | DROPPED  |
|                          |  | NO BYTES ARE SENT  |          |

FIG. 17

| COMPRESSION EXAMPLE 4    |  |  |
|--------------------------|--|--|
| PREVIOUS DATA            |  | 10000011 00000100 11111111 11111111                                  |
| NEW DATA                 |  | 11111111 11111111 11111111 11111111                                  |
| COMPRESSION BIT MAP SENT |  | YES BECAUSE TWO OR MORE BYTES NOT COVERED BY SIGN EXTENSION COMPRESS |
| SEND BYTES               |  | DROPPED DROPPED DROPPED DROPPED                                      |
| NO BYTES ARE SENT        |  |  |

FIG. 18

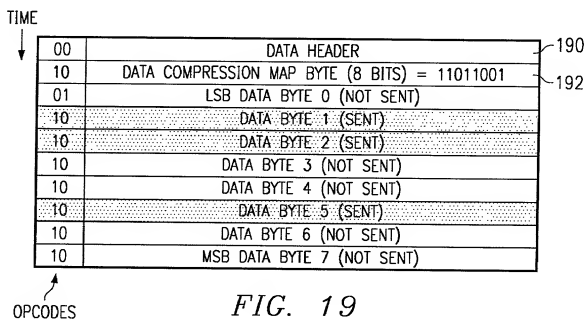
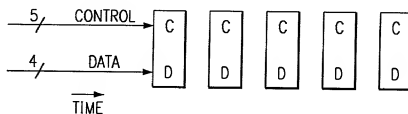


FIG. 19

FIG. 20  
(PRIOR ART)

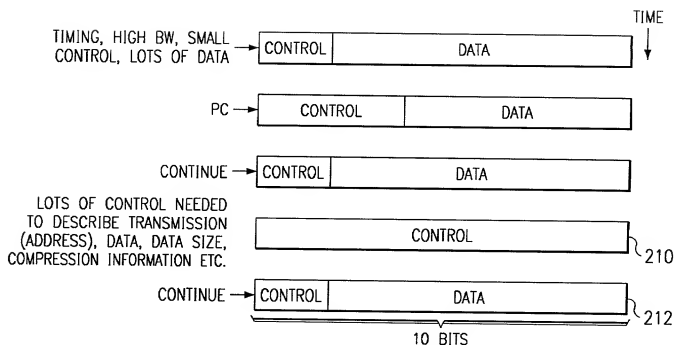


FIG. 21

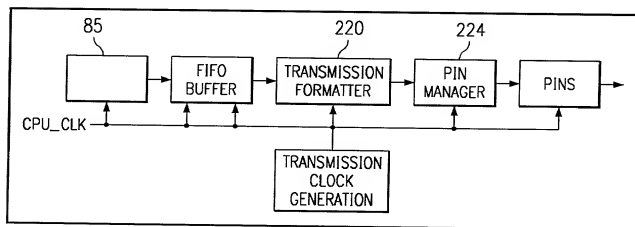


FIG. 22

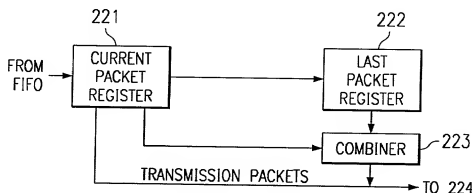


FIG. 22A



| 6 TRACE PACKETS TRANSMITTED AS 10 TRANSMISSION PACKETS |   |    |   |    |   |    |   |    |   |    |   |
|--|---|----|---|----|---|----|---|----|---|----|---|
| 10   |   | 10 |   | 10 |   | 10 |   | 10 |   | 10 |   |
| 6  | 6 | 6  | 6 | 6  | 6 | 6  | 6 | 6  | 6 | 6  | 6 |
| TIME →   |   |    |   |    |   |    |   |    |   |    |   |

FIG. 23

|    |    |    |    |    |    |
|----|----|----|----|----|----|
| 10 | 10 | 10 | 10 | 10 | 10 |
| 12 | 12 | 12 | 12 | 12 | 12 |

FIG. 23A

|    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|
| 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |

FIG. 23B

| REGISTER<br>221 |                             |   |   |   |   |   |   |   |   |   | REGISTER<br>222 |                                |   |   |   |   |   |   |   |   |   |
|-----------------|-----------------------------|---|---|---|---|---|---|---|---|---|-----------------|--------------------------------|---|---|---|---|---|---|---|---|---|
| #               | CURRENT TRANSMISSION PACKET |   |   |   |   |   |   |   |   |   | #               | INCOMPLETE TRANSMISSION PACKET |   |   |   |   |   |   |   |   |   |
| 0               | 9                           | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | EMPTY           |                                |   |   |   |   |   |   |   |   |   |
| 1               | 9                           | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 0               | 9                              | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 1               | 9                           | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 1               | 9                              | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 2               | 9                           | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 1               | 9                              | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 2               | 9                           | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 2               | 9                              | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 3               | 9                           | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 2               | 9                              | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

FIG. 24

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| # | REGISTER |   |   |   |   |   |   |   |   |   | # | REGISTER |   |   |   |   |   |   |   |   |   |
|---|----------|---|---|---|---|---|---|---|---|---|---|----------|---|---|---|---|---|---|---|---|---|
| 0 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |   | EMPTY    |   |   |   |   |   |   |   |   |   |
| 0 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 0 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 0 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 0 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 0 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 1 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 0 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 1 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 1 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 2 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 1 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

FIG. 25

| # | REGISTER |   |   |   |   |   |   |   |   |   | # | REGISTER |   |   |   |   |   |   |   |   |   |
|---|----------|---|---|---|---|---|---|---|---|---|---|----------|---|---|---|---|---|---|---|---|---|
| 0 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |   | EMPTY    |   |   |   |   |   |   |   |   |   |
| Z | -        | - | Z | E | R | O | E | S | - | - | 0 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Z | -        | - | Z | E | R | O | E | S | - | - | Z | -        | - | Z | E | R | O | E | S | - | - |
| Z | -        | - | Z | E | R | O | E | S | - | - | Z | -        | - | Z | E | R | O | E | S | - | - |
| 1 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Z | -        | - | Z | E | R | O | E | S | - | - |
| 1 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 1 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 2 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 1 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

FIG. 26

| # | REGISTER |   |   |   |   |   |   |   |   |   | # | REGISTER |   |   |   |   |   |   |   |   |   |
|---|----------|---|---|---|---|---|---|---|---|---|---|----------|---|---|---|---|---|---|---|---|---|
| 0 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |   | EMPTY    |   |   |   |   |   |   |   |   |   |
| Z | -        | - | Z | E | R | O | E | S | - | - | 0 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Z | -        | - | Z | E | R | O | E | S | - | - | Z | -        | - | Z | E | R | O | E | S | - | - |
| Z | -        | - | Z | E | R | O | E | S | - | - | Z | -        | - | Z | E | R | O | E | S | - | - |
| Z | -        | - | Z | E | R | O | E | S | - | - | Z | -        | - | Z | E | R | O | E | S | - | - |
| Z | -        | - | Z | E | R | O | E | S | - | - | Z | -        | - | Z | E | R | O | E | S | - | - |
| Z | -        | - | Z | E | R | O | E | S | - | - | Z | -        | - | Z | E | R | O | E | S | - | - |
| 1 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Z | -        | - | Z | E | R | O | E | S | - | - |
| 1 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 1 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 2 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 2 | 9        | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

FIG. 27